PATENT SPECIFICATION 887,150

DRAWINGS ATTACHED.

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COMPLETE SPECIFICATION.

Well Tools.

We, OTIS ENGINEERING CORPORATION, a Corporation duly organized and existing under the laws of the State of Texas, United States of America, of 6612 Denton Drive, Dallas 35, State of Texas, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to well tools and more particularly to well packers.

One object of the invention is to provide a new and improved packer for supporting tubing or the like in the well casing.

Another object of this invention is to provide a packer, of the type described, which may be lowered into place in the well and removed therefrom by means of a flexible line.

Still another object of the invention is to provide a removable packer having expansible lugs for holding the packer in place and a locking means for locking said lugs in expanded position when a seal nipple is disposed in said packer.

A further object of the invention is to provide a new and improved packer having selector lugs for arresting downward movement of the packer at a selected location in a well casing.

A still further object of the invention is to provide a packer, of the type described, wherein releasable locking means is provided for locking the selector lugs in expanded position.

Another object of the invention is to provide a new and improved packer, of the type described, having means biasing the selector lugs toward expanded position and a locking means for locking said selector lugs in expanded position.

Still another object of the invention is to provide a new and improved packer, of the type described, wherein the biasing means are mounted on and form a part of the running tool by means of which the packer is lowered into the well.

Additional objects and advantages of the invention will readily be apparent from the reading of the following description of devices constructed in accordance with the invention, and reference to the accompanying drawings thereof, wherein:—

Figures 1 and 2 are views, partly in elevation and partly in section, of a new and improved packer showing the same being lowered through a well casing;

Figures 3 and 4 are views, similar to Figures 1 and 2, showing the packer locked in place in the well casing and supporting a seal nipple;

Figures 5 and 6 are views, partly in elevation and partly in section, of a modified form of packer, which has selector keys, showing the same being lowered through a well casing;

Figures 7 and 8 are views, similar to Figures 5 and 6, showing the modified form of packer locked in place in the well casing and supporting a seal nipple;

Figure 9 is a horizontal sectional view taken on the line 9—9 of Figure 5;

Figure 10 is a view, partly in elevation and partly in section, of another modified form of the packer having locking lugs as well as selector keys, showing the selector keys and locking lugs in position in a landing nipple but not locked therein;

Figure 11 is a view, similar to Figure 10,

showing the packer positioned in the landing nipple with the locking lugs in locked position;

Figure 12 is a horizontal sectional view taken in the line 12—12 of Figure 10;

Figure 13 is a view, partly in elevation and partly in section, of a further modified form of the packer having selector locking keys only, showing the selector locking keys in position in a landing nipple but not locked therein;

Figure 14 is a view similar to Figure 13 showing the selector locking keys in locking position in the landing nipple; and

Figure 15 is a horizontal sectional view taken on the line 15—15 of Figure 13.

Referring now especially to Figures 1 through 4 of the drawings, the numeral 20 designates a well packer which includes an elongate tubular packer body or mandrel formed of an upper tubular packer section 21 and a lower tubular section 22 whose upper end is telescoped in the lower end portion of the upper packer section 21, the two sections being rigidly secured to one another, as by a weld 23. A pressure-operated packing assembly 24, is disposed on the reduced lower end portion of the upper packer section 21 and is held in place between an external annular downwardly facing shoulder 25 and a retaining ring 26 threaded on the lower end of the upper section and held against rotation thereabout by a set screw 27. The packing assembly 24, as shown, includes two sets 28 and 29 of rings which face in opposite directions whereby flow of fluids in either direction past the outer surface of the packer may be prevented, though other arrangements may be used if desired.

The upper section 21 of the packer body or mandrel is provided with a plurality of lateral apertures 30 in which are movably disposed expansible lugs 31. The lugs have downwardly and outwardly inclined beveled surfaces or shoulders 32 at their upper ends, and upwardly and outwardly inclined beveled surfaces or shoulders 33 at their lower ends, which are adapted to cam the lugs inwardly as they contact obstructions in the passage of the packer through a well conductor.

The lugs are movable into expanded positions by an expander sleeve 34 which is slidably mounted in the upper section 21. The expander sleeve is initially held in raised position in the upper packer section 21, as shown in Figure 1, by a shear pin or bolt 35, and its movement in the upper section is limited by a split ring stop 36 secured to the upper section by bolts 37, said ring stop extending inwardly into an external annular groove 38 provided in the expander sleeve. It will be seen that the upper annular shoulder 39 and the lower annular shoulder 40 defining the groove 38 are adapted to abut opposite ends of the ring stop to limit the movement of the expander sleeve 34 in opposite directions with respect to the upper packer section.

The expander sleeve is provided with an annular inwardly and downwardly inclined or beveled expanding surface 41, and this expanding surface is adapted to contact an upwardly inclined bevel surface or shoulder 42 at the upper inner end of each of the lugs as the expander sleeve is moved downwardly from the position shown in Figure 1 to the position shown in Figure 3. The expander sleeve thus expands the locking lugs when it is moved downwardly therebetween.

The expander sleeve 34 also has a lower collet section 43 providing resilient prongs 44. The prongs have bosses 45 which are adapted to extend into an annular groove or recess 46 in the bore of the packer defined by the downwardly and outwardly inclined shoulder 47 of the upper packer section 21 and the outwardly and upwardly inclined shoulder 48 of the lower section 22. The bosses 45 have downwardly and outwardly inclined surfaces 49 which are adapted to contact the shoulder 47, when the expander sleeve is raised upwardly in the packer, whereby the prongs 44 are cammed inwardly to permit continued upward movement of the expander sleeve. Thus, the expanding surface 41 may move to a position above the lugs 31, which are then free to move inwardly.

The upper end of the expander sleeve 34 has an internal groove 50 at the upper end of which is an internal flange 51 disposed to be engaged by a suitable running tool secured to a flexible line running mechanism (not shown). The packer may be lowered into a well casing 52 by means of the running tool and flexible line.

The well casing 52 includes a landing nipple 53 having suitable threaded end portions whereby the said nipple may be connected to adjacent sections of said well casing. The landing nipple is provided with an internal stop shoulder 55 which engages an external downwardly facing annular stop shoulder 56 on the upper packer section to stop downward movement of the packer in the well casing. When the downward movement of the packer is stopped, the lugs 31, which are then in retracted position, are aligned with an internal locking groove 57 formed in the bore of the landing nipple, and downward jars imparted to the upper end of the expander sleeve 34 by the running tool will shear the shear pin 35. Further downward jars then move the expander sleeve downwardly and cause the expanding surface 41, which contacts the surfaces 42 of the lugs, to move the lugs outwardly into the locking groove. Also, the prongs 44 are caused to bend inwardly due to the camming

action of the beveled surface 58 of the upper packer section 21 on the bosses 45, as the expander sleeve moves downwardly in the packer. The expander sleeve is moved downwardly until the bosses on the prongs are aligned with the annular groove 46, whereupon the prongs flex outwardly and the bosses are engaged in the annular groove and thus hold the expander sleeve against movement in the packer. Further downward movement of the expander sleeve is now limited by the engagement of the expander surface 41 with the beveled shoulder 58 in the bore of the upper packer section.

The running tool 106 shown in Figure 1 may be employed to lower the packer into and remove it from the well casing string. The running tool includes a tubular carrier or body 107 on whose upper end may be threaded a connector fitting by means of which it is secured to a flexible line running mechanism. The tubular carrier is provided intermediate its ends with an external flange 108 below which are disposed a plurality of supporting members or dogs 109 having outwardly extending hooks or catches 110 at their lower ends. The dogs are biased outwardly into engagement with the flange 51 of the expander sleeve by springs 111, which bear against the under side of the carrier flange 108 and the upper ends of the dogs and force the lower ends of the dogs along a downwardly and outwardly inclined wedge surface 107*a* at the lower end of the tubular carrier. A sleeve 112 having a skirt 112*a* is releasably secured to the tubular carrier by a shear pin 113, which extends through a shear ring 113*a* secured in the upper end of the skirt and holds the skirt in the position shown in Figure 1 against the upward force exerted by the strong helical coil spring 114 which is supported on the external flange 108 of the carrier and bears against the shear ring carried by the skirt.

It will be apparent that when downward jars are imparted to the running tool through the flexible line running mechanism, the pin 113 will be sheared and the strong spring 114 will move the skirt upwardly against the force of the weak springs 111. An internal flange 115 at the lower end of the skirt engages external flanges 116 near the upper ends of the dogs and carries the dogs upwardly during such movement of the skirt. Upwardly and outwardly beveled surfaces 117 on the upper ends of the dogs then come into contact with a similarly beveled surface 118 on the lower edge of the external flange 108, which causes the lower ends of the dogs to pivot inwardly and out of engagement with the flange 51 in the upper end of the bore of the expander sleeve of the packer. After downward jars have been imparted to the expander sleeve to drive it downwardly, the running tool may then be removed from the casing leaving the packer in place.

When the expander sleeve is pulled up to the position wherein the annular shoulder 40 of said expander sleeve engages the stop 36 of the packer, further upward movement of the expander sleeve will cause the packer 20 to be moved upwardly in the casing. When this happens the beveled shoulders 32 on the upper outer edges of the lugs contact the downwardly and outwardly inclined annular shoulder 61 at the upper end of the internal locking groove of the landing nipple 53, and the lugs are cammed inwardly. The lugs are free to move inwardly since the expanding surface 41 is then disposed above the lugs. Thus, the packer may be easily moved into and locked in position in the landing nipple by a suitabl running tool operable by means of a flexible line running mechanism, and may also be easily removed by such a tool and flexible line mechanism.

The packer 20 is adapted to receive a tubular sealing nipple 62 having a lower section 63, an upper section 64 threaded into the upper end of the lower section 63, and a landing head section 65 threaded into the upper end of the upper section. The landing head section has an external flange providing a stop or head 67 which engages an internal stop shoulder 68 in the upper portion of the expander sleeve 34 to limit downward movement of the sealing nipple in the packer. The landing head section is threaded on the lower end of a joint of the string of flow pipe or tubing 69 by means of which the sealing nipple and landing head are lowered into the well.

The upper sealing nipple section 64 fits closely in the expander sleeve and locks the prongs 44 of the collet section 43 of the expander sleeve in the position shown in Figure 3, so that the packer can not be moved upwardly until the sealing nipple is removed from the packer. During the time the sealing nipple is in the packer, the bore of the packer is reduced thereby and the upward force exerted on the packer by the pressure of the well fluid is greatly increased. However, the packer is positively held in place against upward displacement because the bosses on the prongs 44 of the collet section cannot be moved out of engagement with the shoulder 47 in the upper packer section due to the presence of the upper section 64 of the sealing nipple in the bore of the expander sleeve.

An upper packing assembly 70 on the upper section 64 of the sealing nipple is held in place between an annular shoulder 71 on the upper section and a split lock ring 72 secured on the lower end of said upper section by the upper end of the lower section 63 of the sealing nipple.

An annular lower seal or packing assembly 73 on the lower section 63 of the sealing

nipple is held in place between an annular shoulder 74 on the lower end of the lower section and a split lock ring 75 which is secured on said lower section by a sub threaded on the lower end thereof. The lower end of the sub may be threaded whereby flow tubing may be connected to the lower end of the sealing nipple.

It will be noted that the friction between the packing assemblies 70 and 73 and the bore wall of the expander sleeve cannot move the expanding sleeve upwardly when the sealing nipple is moved upwardly, because of the engagement of the bosses 45 of the collet with the shoulder 47 of the upper packer section. This is of great advantage since it is often desirable to remove the sealing nipple while leaving the packer in place.

It will now be seen that a new and improved packer 20 has been provided which may be lowered into a well casing by means of a flexible line running mechanism, and which may be removably locked in position in a well by means of the lugs 31 after its downward movement has been stopped by the stop shoulder 56 of the packer abutting the shoulder 55 of the landing nipple in the well casing. It will be seen that the lugs 31 are moved into and held in expanded position by an expander sleeve 34 which is in turn held in a lower locking position by engagement of the bosses 45 of the collet section 43 of the sleeve in the annular groove or recess 46. Moreover, it will be seen that the packer is adapted to receive a sealing nipple 62 and that the sealing nipple, when in position in the packer, abuts the collet section to prevent inward movement of the prongs 44 thereof whereby the packer is held positively against upward movement in the casing as long as the sealing nipple is in place.

In Figures 5 through 9 is shown a modified form of the invention, wherein the packer 80 is provided with lugs 81 moved into expanded position by an expander sleeve 82 having a collet section 83. The collet section has bosses 84 which extend into the annular recess 85 in the bore wall of the packer to hold the expander sleeve in its lower position. It will be seen that the packer 80 is in these particulars identical in structure and function with the packer 20 illustrated in Figures 1 to 4. The packer 80 differs from the packer 20 in that its downward movement in the well casing is arrested, not by stop shoulders such as the stop shoulders 55 and 56 of the packer and the well casing shown in Figures 1 and 2, but by selector keys 86 slidably mounted on the extended lower portion of the body or mandrel of the packer 80 by means of a retainer or carrier sleeve 87 which is locked in place on the packer by bolts 88 extending into a split retainer ring 89 in an annular recess in the lower portion of the packer.

The carrier sleeve has a plurality of radially spaced longitudinal slots 91 and a selector key 86 is disposed in each slot. The outward movement of the selector keys is limited by the engagement of their upper and lower end portions 92 with the wall of the carrier sleeve at the upper and lower ends of the slots. Each selector key is biased outwardly by a spring 93 whose opposite ends bear against the packer body or mandrel and whose intermediate portion bears against the inner side of the selector key, though the spring may be oppositely positioned and still function properly.

Each selector key 86 has an outer configuration which corresponds to the inner configuration of a selector groove 90 in the bore of only one of several landing nipples 94 which may be connected in the well casing of a well at various depths of the well and each having selector grooves of different configuration or size or both. When it then becomes desirable to install a packer 80 in the well casing at a selected depth, the packer is provided with selector keys 86 whose configuration conforms to that of the selector groove 90 of the landing nipple 94 found at that selected depth.

The packer is then lowered into the well, and the selector keys engage the walls of the casing and move inwardly against the force of the springs 93 since the beveled surface of the lower guide bosses 96 of the keys cam the keys inwardly as they contact obstructions during such downward movement. The selector keys also have upper selector bosses 97, and the keys are unable to move to expanded position until they are aligned with the annular selector groove 90 of a landing nipple 94 of the same size and configuration as the bosses 97 and 96 of the selector keys. When the keys move outwardly into expanded position the downwardly facing stop shoulder 100 at the lower end of the selector boss of each key engages the upwardly facing stop shoulder 101 of the selector groove of the proper landing nipple, and since these shoulders are disposed substantially perpendicular to the longitudinal axis of the landing nipple, further downward movement of the packer is stopped. The expander sleeve 82 may then be jarred downwardly to expand the lugs and lock the packer against upward movement.

It will be seen that, as the upper ends of the bosses 96 and 97 are inclined upwardly and inwardly and the upper shoulders 104 and 105 of the selector groove are similarly inclined, the keys will be cammed inwardly by the engagement of the ends of the bosses with those shoulders upon upward movement of the packer in the landing nipple. The selector keys thus limit downward movement of the packer but permit upward movement thereof.

It will be apparent that in this modified form of the packer, the selector keys and selector groove permit use of landing nipples having larger internal diameters and unrestricted bores, due to the omission of an inwardly extending stop shoulder in the nipple which would restrict the bore of the nipple. Moreover, it will be seen that the absence of such a stop shoulder permits the use of a series of this form of packers in the same string of casing, since each packer may pass through all landing nipples of the casing except the one whose selector groove has an internal configuration and size which corresponds to the configuration and size of the lugs of the selector keys of the packer.

Another form of the packer is shown in Figures 10 through 12, wherein the packer 119 includes a mandrel or body 120 which is provided with a pair of selector keys 121 and a pair of locking lugs 122 mounted in lateral apertures in the mandrel. Each of the keys and lugs has notches or recesses 123 formed in its sides which receive the projecting ends of pins 124 carried by the mandrel and engaging in the recesses to limit the inward and outward movement of the keys and lugs.

The keys and lugs are each yieldably biased outwardly by a spring 125 secured at its upper end to a retaining ring 126 by rivets 127 or the like. The retaining ring is rigidly secured to an elongate tubular stem 128, as by welding. The lower ends of the springs are secured to a lower slide ring 129, as by rivets 130, and said slide ring is longitudinally movable on the tubular stem.

The upper end of the tubular stem is threaded to the tubular carrier or body 131 of a running tool 132, similar to that of the running tool shown in Figure 1. The running tool is similar in all other respects to the running tool 106 of Figure 1, and will not, therefore, be described in further detail, except to point out that the dogs 133 and skirt 134 correspond to the dogs 109 and the skirt 112 of the running tool shown in Figure 1.

A locking sleeve 135 is releasably secured to the packer mandrel 120, in the position shown in Figure 10, by a plurality of shear screws 136 threaded through a ring 137 rigidly secured on the upper end of the packer mandrel by a cap ring 138 threaded on the upper end of said packer mandrel. The shear screws have inner ends which extend into an annular groove 139 formed in the exterior of the spring retaining ring 126, so that the locking sleeve is also releasably connected to the packer mandrel.

The enlarged head 140 at the upper end of the locking sleeve has an internal annular recess 140*a* in which the hooks on the lower ends of the dogs 133 of the running tool may engage, and the annular downwardly facing stop shoulder 141 at the lower end of the head is adapted to engage the upper end of the packer mandrel to limit downward movement of the locking sleeve in said packer mandrel. The locking sleeve also has an external annular flange 142 intermediate its ends providing an upwardly facing stop shoulder 143 which is adapted to engage the lower end of the ring 137 to limit upward movement of the locking sleeve with respect to the packer mandrel.

The selector keys 121 have an outer configuration and size which correspond to the inner configuration and size of the selector groove of only one of the several landing nipples 144 which may be connected in the well casing of a well at various depths therein. The landing nipples are threaded at both ends so that they may be connected to and between two adjoining sections of the well casing so as to form a part of said string of casing. When it becomes desirable to install a packer in the well casing at a selected depth, the packer is provided with selector keys whose size and configuration conforms to that of the landing nipple disposed at that desired depth.

The packer is lowered into the well by means of the running tool 132, the selector keys 121 and the locking lugs 122 engaging the walls of the casing and camming inwardly against the resistance of the springs 125 as they encounter obstructions, since the downwardly facing shoulders 145 of the lugs and downwardly facing shoulder 146 of the lower guide bosses 148 of the selector keys are beveled upwardly and outwardly. The guide bosses prevent the stop shoulder 147 at the lower end of the selector boss 149 from engaging obstructions until the selector keys are aligned with a landing nipple selector groove section 150 having annular grooves 151 and 152 of the same length and spacing as the bosses of the selector keys.

When the selector keys move outwardly into expanded position in the selector groove, the downwardly facing stop shoulder 147 of each key engages an upwardly facing stop shoulder 153 in the selector groove, and since these shoulders are disposed substantially perpendicular to the longitudinal axis of the landing nipple, further downward movement of the packer mandrel 120 is stopped. The various elements of the running tool and the packer 119 are then in the positions shown in Figure 10, the selector bosses 149 and the locking lugs 122 being disposed in the upper groove 151 of the selector groove section and the guide bosses 148 being disposed in the lower groove 152 of said selector groove section.

Downward jars are then imparted to the running tool, and by means of the skirt 132 of the running tool to the upper end of the locking sleeve 135, to shear the shear screws

136 and drive the locking sleeve downwardly in the packer mandrel between the selector keys and locking lugs and the springs 125.

The locking sleeve has resilient collet prongs 154, provided at their lower ends with bosses 155 having outwardly convergent upper and lower shoulders 156 and 157 which cause the collet prongs to cam inwardly upon meeting internal obstructions in the bore of the packer mandrel.

When the locking sleeve reaches the limit of its downward movement, the stop shoulder 141 engages the upper end of the packer mandrel and the collet prong bosses enter into an annular recess or groove 158 formed in the bore of the packer mandrel below the locking lugs and adjacent the lower ends of the selector keys, so that the collet prong bosses detachably lock the locking sleeve in the lower locking position shown in Figure 11. It will be noted that the lower inner ends of the selector keys are provided with recesses 159 corresponding with the groove 158 and which receive the upper portions of the collet prong bosses so that these bosses also engage and hold the selector keys expanded when the locking sleeve is in the locking position.

Further downward jars are then imparted to the running tool to cause the dogs 133 to retract, and the running tool is then pulled upwardly to remove the tubular stem 128 and the springs 125 from within the bore of the packer mandrel. The packer is thus left in place with the locking sleeve holding the locking lugs and selector keys locked in expanded positions, so that fluid pressure differentials will not dislodge the packer from the landing nipple.

The packer mandrel, of course, is provided with an external packing assembly 160 held in place on the mandrel by a retainer ring 161, and this packing assembly seals between the packer mandrel and the landing nipple. A sealing nipple, such as the nipple 62 of Figures 3 and 4, may then be positioned in the bore of the packer 119, if desired.

When it is desired to remove the packer, a suitable running tool is lowered into the well casing and engages the shoulder 162 at the upper end of the internal groove 140*a* in the head of the locking sleeve, whereby the locking sleeve may be pulled upward. When the locking sleeve is pulled upwardly, the beveled upper surfaces 156 of the collet prong bosses cam the prongs inwardly, thus permitting the locking sleeve to move upwardly in the packer mandrel until the stop shoulder 143 on the sleeve abuts the lower end of the ring 137, whereupon further upward movement of the locking sleeve causes the packer mandrel to move upwardly. This upward movement of the packer mandrel is now possible because the locking sleeve is now above the locking lugs and selector keys, and the latter are free to move inwardly, their upwardly facing shoulders being inclined downwardly and outwardly so that, upon engaging surfaces of the landing nipple and the casing string, they urge the keys and lugs inwardly to retracted positions.

It will be seen that in this modified form of the packer, the springs 125 which bias the locking lugs and selector keys outwardly are a part of the running tool and are removed after the packer has been located and locked in a selected landing nipple, thereby providing a packer having a very large bore as compared with the packer shown in Figures 5 through 9. Also, the locating of the locking lugs and selector keys in radially offset positions, so they may engage in a common selector groove in the landing nipple, provides a shorter packer and landing nipple, while retaining the benefits of the full opening through the landing nipple.

In Figures 13 to 15 is shown a packer 163, which is similar in all respects to the packer 119 of Figures 10 through 12, except that the locking lugs 122 are replaced by another pair of selector keys 121. Since the mode of operation and structure of the packer 163 is identical in all other respects with those of the packer 119, all corresponding elements have been provided with the same reference numerals and will not be described further.

It will be seen that the selector keys 121 serve to hold the packer in place in the landing nipple when the locking sleeve is in the position shown in Figure 14, wherein it engages the inner surfaces of the selector keys to prevent inward movement of the keys.

This form of the packer has all the advantages of the form shown in Figures 10 through 12, and in addition provides a greater shear area on the selector keys which lock the packer in place in the landing nipple.

The foregoing description of the invention is explanatory only, and changes in the details of the constructions illustrated may be made by those skilled in the art, within the scope of the appended claims, without departing from the spirit of the invention.

WHAT WE CLAIM IS:—

1. A removable anchoring and sealing device for use in wells having an elongate tubular member adapted to be releasably secured within a landing nipple which connects an upper and a lower portion of a well casing, said tubular member being provided with a lateral aperture with a locking lug mounted for movement between a retracted position and a position in which same projects beyond the outer surface of the tubular member into a recess in the inner surface of the landing nipple, including an expander sleeve mounted for limited longitudinal slid-

ing movement within said tubular member to and from a position in which the expander sleeve holds the locking lug in said projecting position, and an inner sleeve member movable longitudinally in the bore of said expander sleeve for restraining said expander sleeve in its position holding said locking lug in said projecting locking position.

2. A device as set forth in Claim 1, including restraining means on the expander sleeve and said tubular member co-acting resiliently for restraining the expander sleeve in position holding the locking lug in said projecting position.

3. A device as set forth in Claim 2, including interengaging stop means on said tubular member and the landing nipple to limit downward movement of the tubular member in said landing nipple, said interengaging stop means including a downwardly facing shoulder on a selector key mounted in a lateral opening in said tubular member for transverse movement into engagement with an upwardly facing shoulder on said landing nipple under the action of a spring means having one end secured to said inner sleeve within said expander sleeve.

4. A device as set forth in Claim 3, including a number of selector keys of different configuration, each adapted to fit in a correspondingly shaped groove in one of a plurality of vertically spaced landing nipples, whereby keys of only one preselected size are used at one time, so that said anchoring and sealing device will be stopped and positioned at a single preselected landing nipple.

5. A device as set forth in Claim 4, in which the locking members expand into locking position to hold said device securely anchored in said preselected landing nipple.

6. A device as set forth in Claims 4 and 5, in which said selector keys are positioned in the same grooves in said landing nipple, as are the locking lugs.

7. A device as set forth in Claims 4 and 5, in which said selector keys are positioned to engage a separate set of grooves.

8. A device as set forth in any one of the preceding claims, in which said inner sleeve is provided with annular sealing means to seal said inner sleeve against the inner surface of said tubular member.

9. A device as set forth in any one of the preceding claims, including annular sealing means between said tubular member and said landing nipple.

10. A device as set forth in Claim 1, wherein the inner sleeve member is provided at its opposite ends with means for securing the same to a well flow conductor so as to form a part of said well flow conductor to be movable with said well flow conductor longitudinally in the well and with respect to said anchoring and sealing device.

11. A removable anchoring and sealing device substantially as herein described with reference to the accompanying drawings.

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Fig. 1

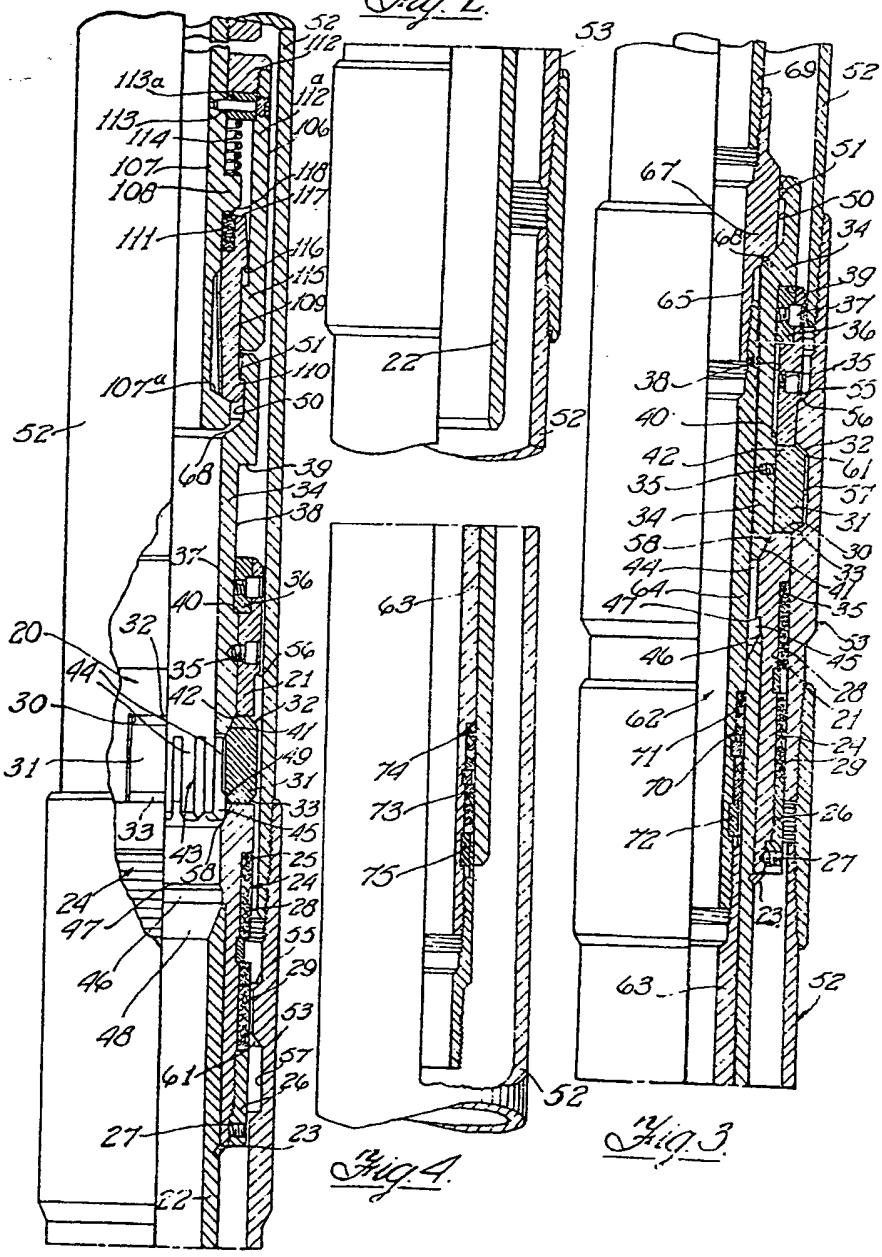

Fig. 2

Fig. 4

Fig. 3

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4 SHEETS

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SHEETS 1 & 2

Fig. 5.

Fig. 6.

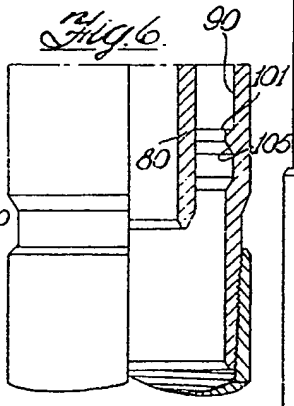


Fig. 8.

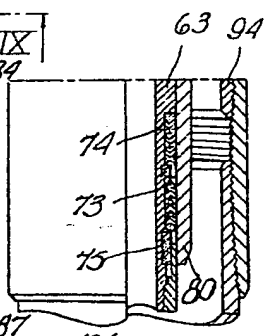
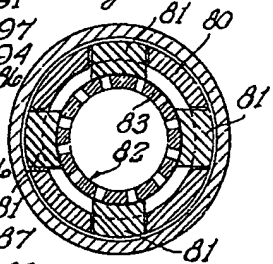


Fig. 9.



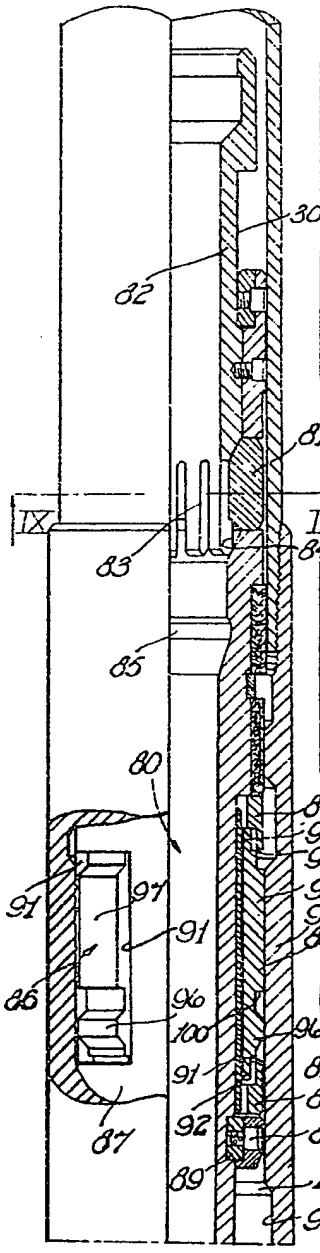
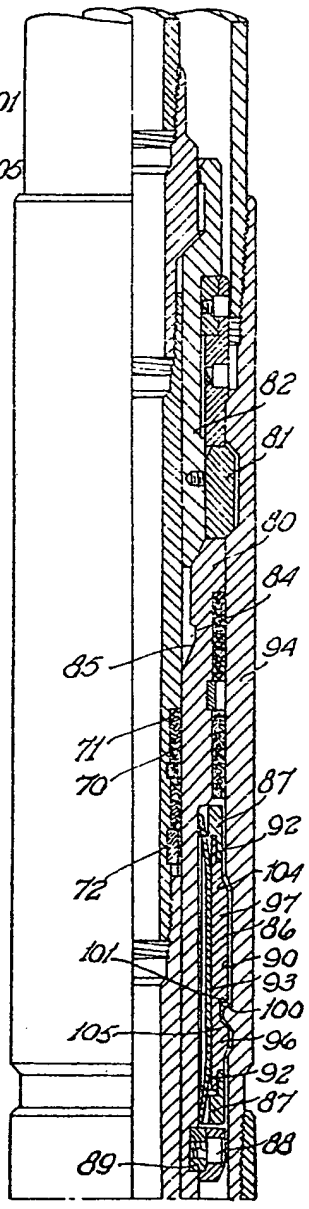


Fig. 7.



887,150 COMPLETE SPECIFICATION

4 SHEETS

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SHEETS 1 & 2

Fig. 1

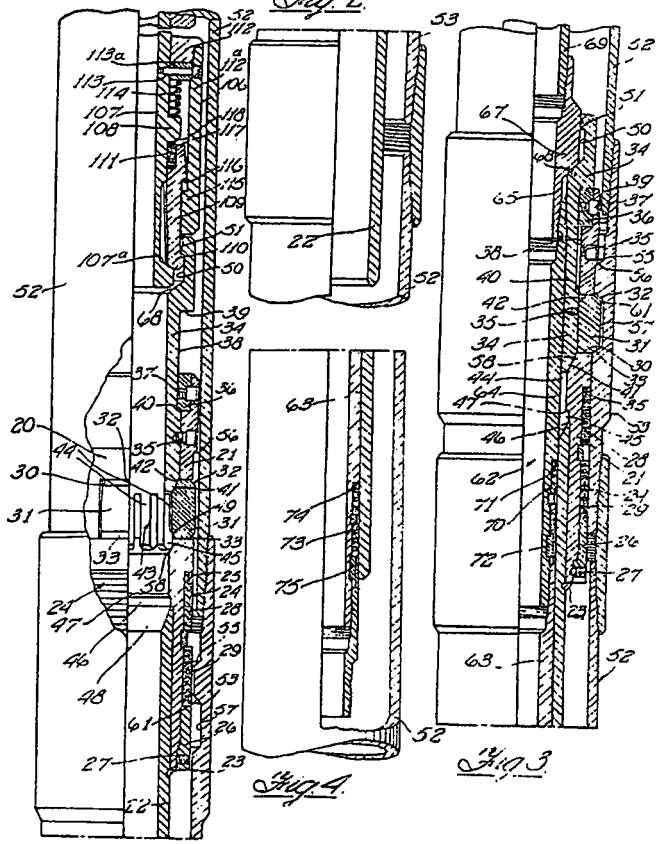


Fig. 2

Fig. 3

Fig. 4

Fig. 5

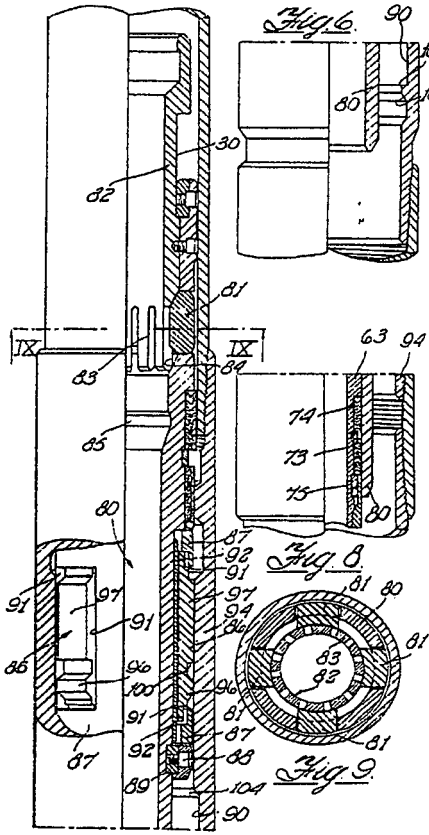
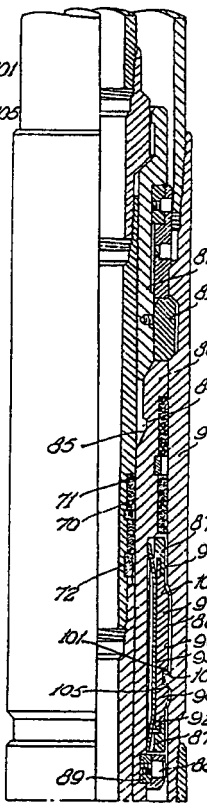


Fig. 6

Fig. 8

Fig. 9

Fig. 7



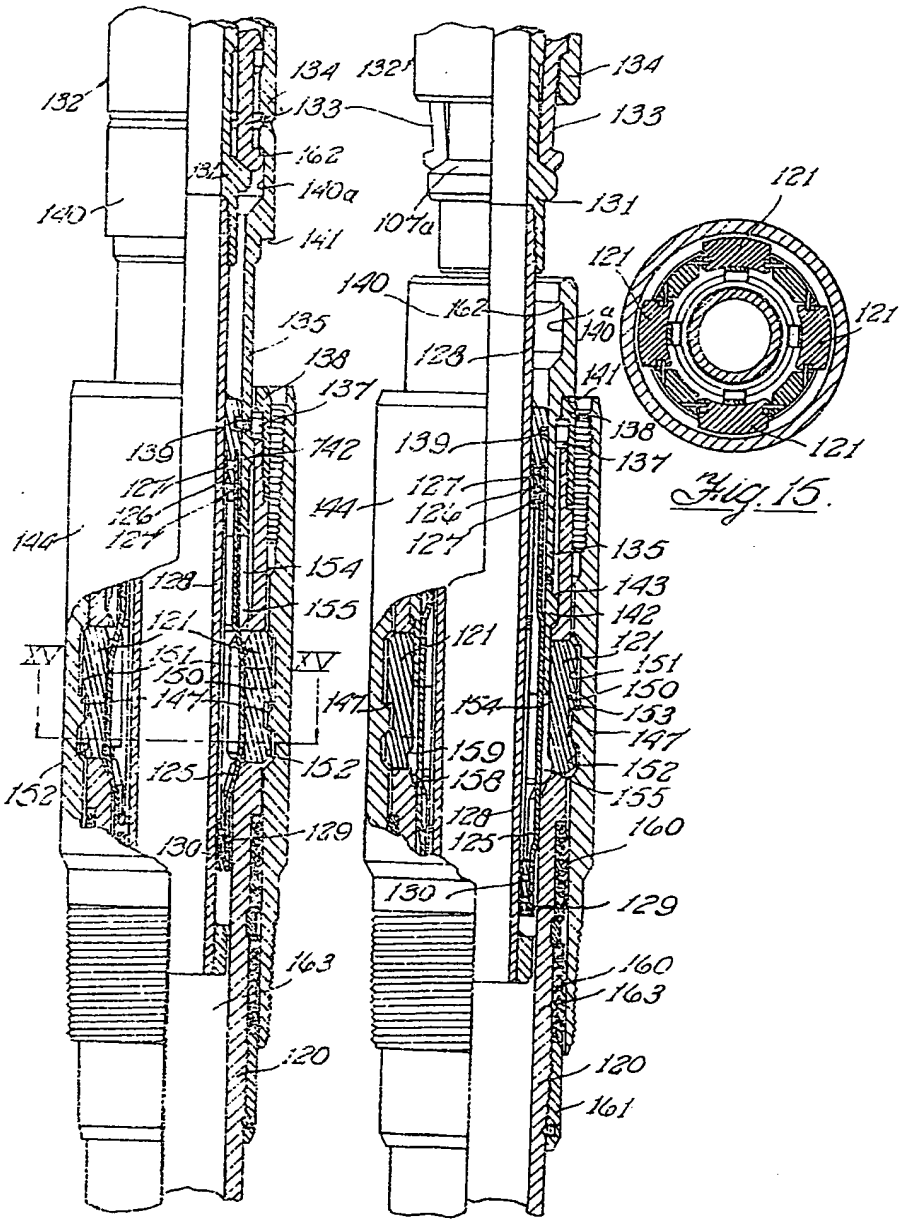


Fig. 13.

Fig. 14

Fig. 15.

887,150 COMPLETE SPECIFICATION
4 SHEETS This drawing is a reproduction of the Original on a reduced scale.
SHEETS 3 & 4

Fig. 15.

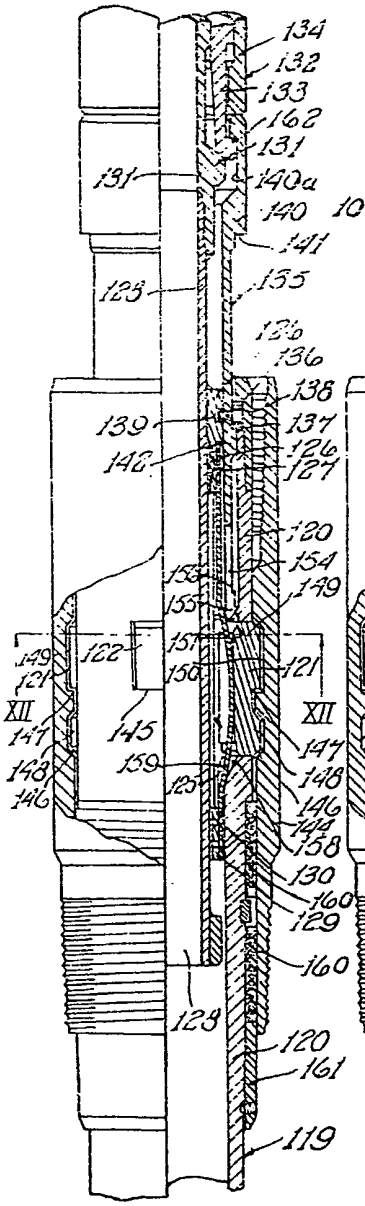


Fig. 10

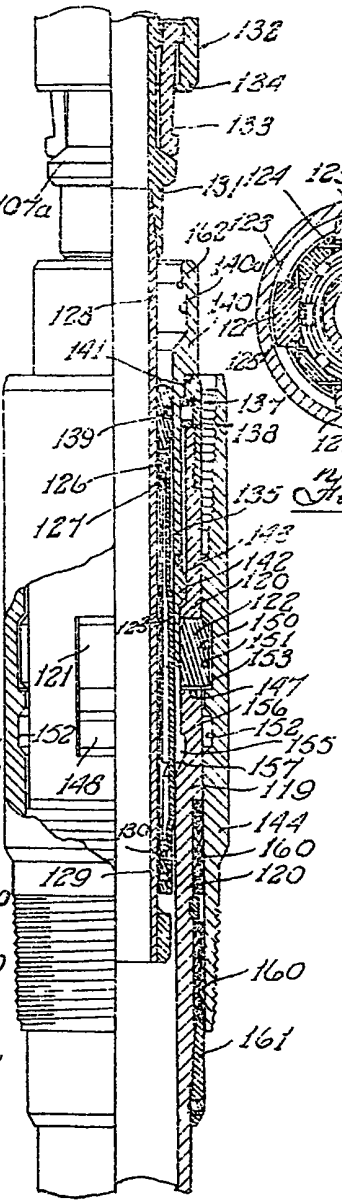


Fig. 11

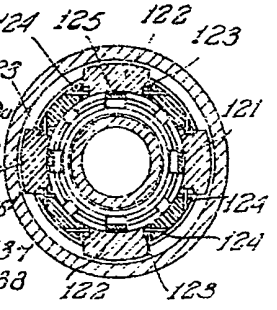


Fig. 12

887,150 COMPLETE SPECIFICATION
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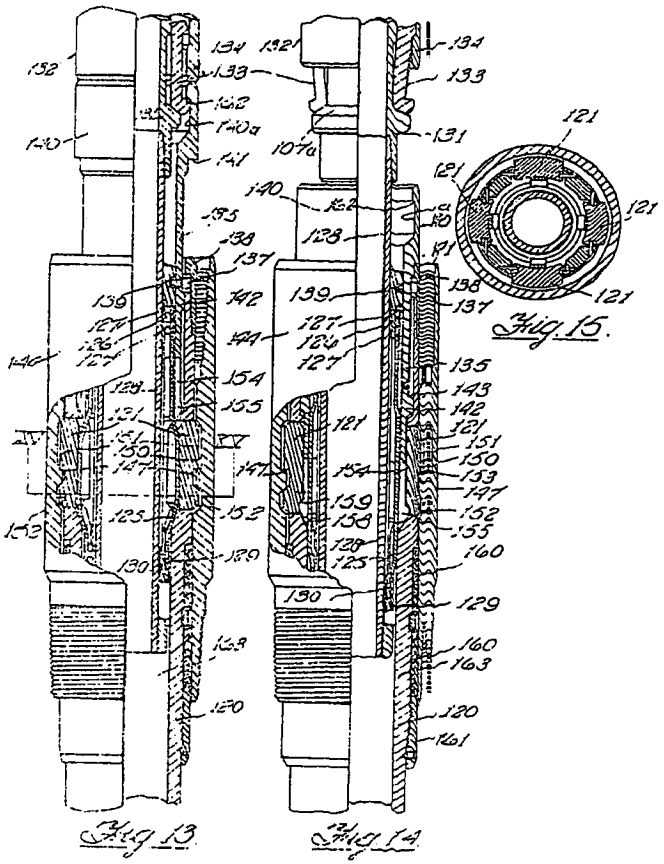

Fig. 13 Fig. 14 Fig. 15.

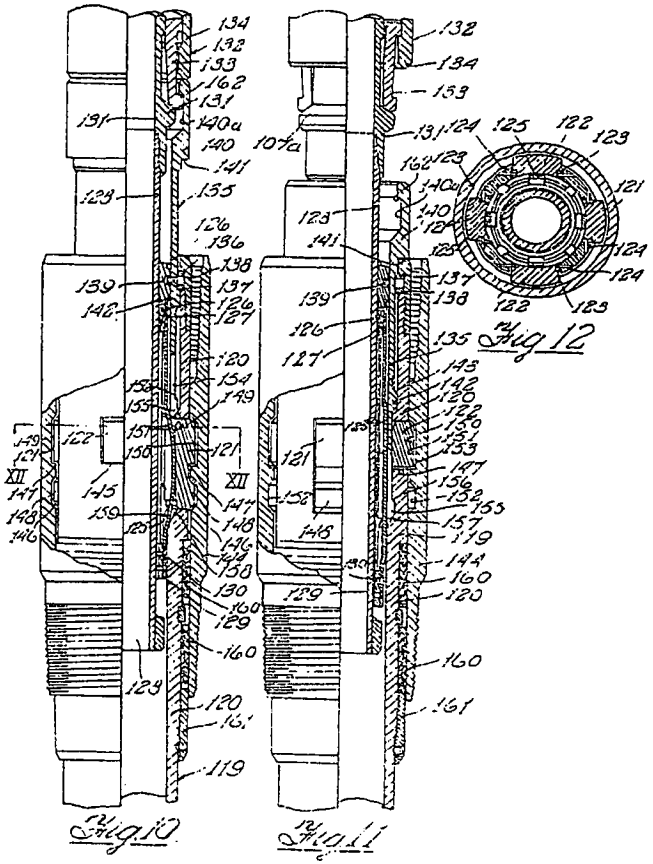

Fig. 10 Fig. 11 Fig. 12